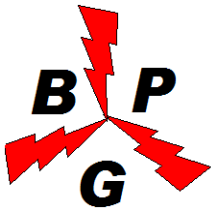


# Proposed Plasma Arc Gasification Project Common Questions

*What is plasma arc gasification anyway?!?*



# FAQ's

So what is plasma arc gasification anyway?

**Plasma Arc Gasification**- is a process that can convert carbon containing (organic) materials, such as municipal solid waste (MSW), tires, biomass (trees/plants) etc, in an electric arc furnace at very high temperatures (8,000<sup>o</sup> F – 10,000<sup>o</sup>F) using a high voltage electric arc with little or no oxygen. The resulting gas mixture is called synthesis gas or syngas and is itself a fuel.

# FAQ's

How is that different from burning or incineration?

**Incineration**- is a process that involves the combustion of organic materials and/or substances at relatively high temperatures reaching 1560°F in an oxygen rich environment. Incineration of waste materials converts the waste into incinerator bottom ash, flue gases, particulates, and heat, which can in turn be used to generate electric power. The flue gases are cleaned of pollutants before they are dispersed in the atmosphere.

# Sounds pretty much the same to me...

At first glance they may look like pretty the much the same thing with some different words but the differences are really night and day. Following are the key differences:

1. Temperature
2. Useful Products
3. Emissions

## Key Differences

### **Temperature-**

In an incinerator, the MSW (for example) is burned at  $\pm 1,500^{\circ}\text{F}$  using natural gas. As you remember in order for something to burn, you need a fuel, a heat source and oxygen.

In a gasifier, the MSW is super heated using an electric arc in an oxygen starved environment at  $\pm 8,000^{\circ}\text{F}$ . At these temperatures, the molecules literally separate into their individual elemental forms, which are mostly Carbon, Oxygen and Hydrogen.

# Key Differences

## Useful Products

**Incineration**-The primary product is heat which is used to boil water and make steam to power a steam turbine and generate electricity. The second product is simply the reduction/destruction of the waste being burned.

**Plasma gasification**- The primary product is synthesis gas (CO and H<sub>2</sub>). The syn gas is cleaned and then some of it is used to power a turbine engine to power the actual gasifier and the remaining syn gas is processed through a series of reaction chambers to form diesel, ethanol and a number of other possible saleable products depending on the market need. Inorganics are captured and removed from the gasifier such as pure sulfur, which can be sold, and the heavy metals are turned into vitrified slag and are inert. The vitrified slag can be sold as aggregate or even turned into tiles.

# Key Differences

## Emissions

**Incineration-** Flue gas is the exhaust produced. It is cleaned and then vented to a stack to discharge into the air. While they can remove some of the NO<sub>x</sub> and the SO<sub>x</sub>, there is a great deal of CO<sub>2</sub> discharged. Finally, there is the burned residue which is ash or fly ash. The inorganic toxins form in this ash. Some are captured and treated while others are simply vented to the air.

**Plasma gasification-** The gasifier does not have any emissions vented to the air. It is a closed loop system with the majority of the syn gas going to the FT converter and some use as fuel for a gas turbine to produce electricity. Since the Syn gas is very clean there are very low emissions from the gas turbine. Inorganic toxins from the gasifier are captured in vitrified slag making them non hazardous per EPA guidelines.

# Emission Comparison

Subsystem	Incineration	vs. Gasification
Combustion vs. Gasification	Designed to maximize the conversion of feedstock to CO <sub>2</sub> and H <sub>2</sub> O	Designed to maximize the conversion of feedstock to CO and H <sub>2</sub>
	Large quantities of excess air	Limited quantities of oxygen
	Highly oxidizing environment	Reducing environment
	Operated at temperatures below the ash melting point. Mineral matter converted to bottom ash and fly ash.	Operated at temperatures above the ash melting point. Mineral matter converted to glassy slag and fine particulate matter (char).
Gas Cleanup	Flue gas cleanup at atmospheric pressure	Syngas cleanup at high pressure.
	Treated flue gas discharged to atmosphere	Treated syngas used for chemical production and/or power production (with subsequent flue gas discharge).
	Fuel sulfur converted to SO <sub>x</sub> and discharged with flue gas.	Recovery of reduced sulfur species in the form of a high purity elemental sulfur or sulfuric acid byproduct.
Residue and Ash/Slag Handling	Bottom ash and fly ash collected, treated, and disposed as hazardous wastes.	Slag is non-leachable, non-hazardous and suitable for use in construction materials. Fine particulate matter recycled to gasifier or processed for metals reclamation.



What do these plants look like? I don't want to see some industrial eyesore in my City.



**Hitachi Metals 200 TPD MSW Plasma Gasification Plant, Utashinai Japan**

The proposed plant will be fully enclosed inside modern buildings. This adds to the modern, progressive look of the area as well as significantly reduces delays from weather events. The insulated buildings will also reduce any adverse noise pollution as well as minimize any odors from the MSW on the tipping floor.



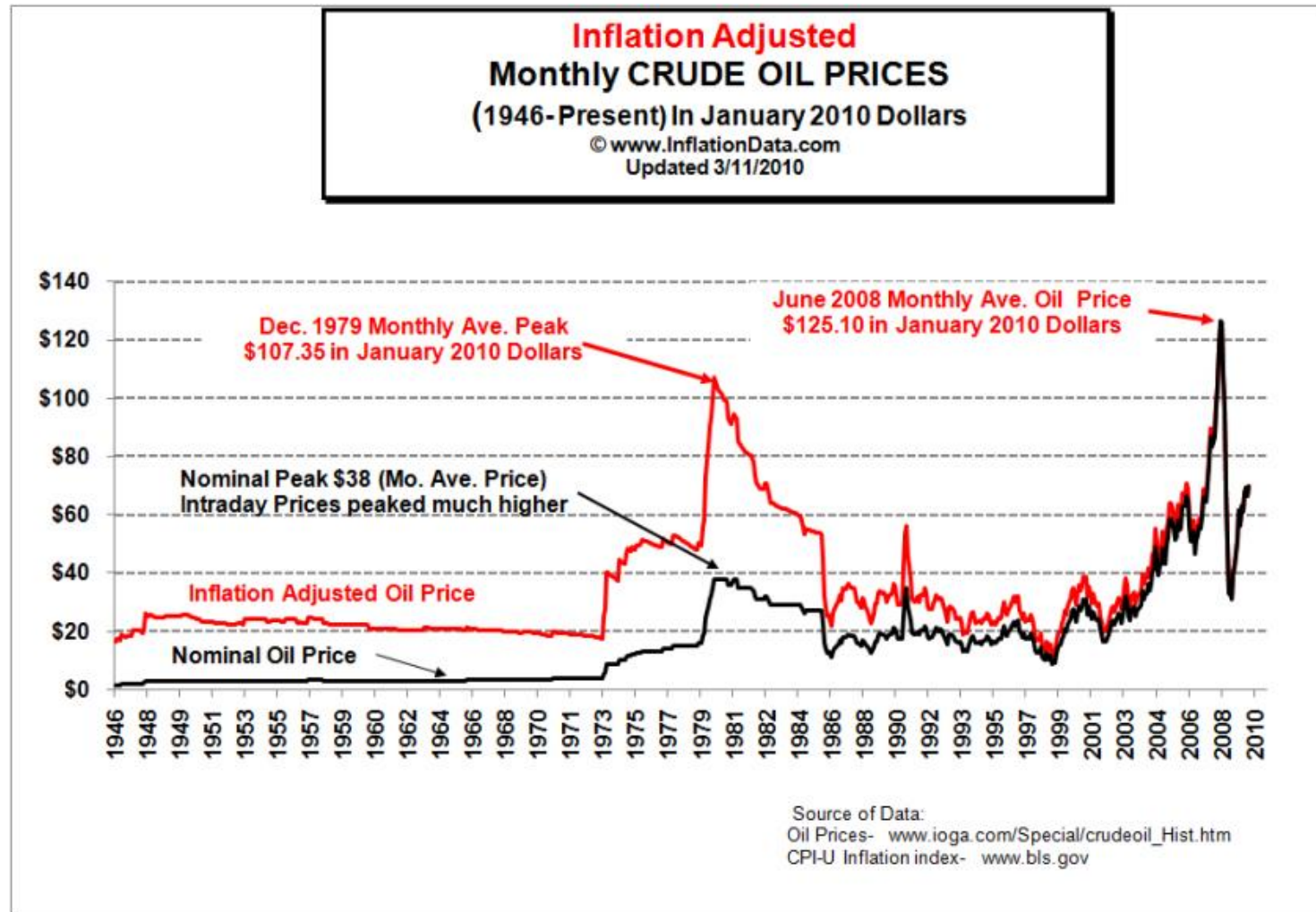
This picture shows a gasifier at a demonstration plant, similar to the size proposed to be used. The actual gasifier is on the left.

If this is so great, why aren't there plasma gasification plants everywhere?

The single biggest reason there aren't plasma gasification plants all over is economics. Simply put, fossil fuel energy has historically been so inexpensive, it was cheaper to just use the fossil fuels to make power. Now with a raised awareness of the environment, the push toward renewable fuels and green energy, plasma gasification is going to be at the forefront. Further, rapidly increasing and fluctuating cost of oil along with the ever increasing amount of political unrest and discord with the countries that supply the US with oil, now is the time for plasma gasification of MSW for energy.

It has never been a question of, “*Did we have the technology?*”

**IT HAS ALWAYS BEEN A QUESTION OF ECONOMICS.**



I've never heard of gasification? Is this new technology?

## History of Gasification

**Town Gas**- a gaseous product manufactured from coal, supplies lighting and heating for America and Europe. Town gas is approximately 50% hydrogen, with the rest comprised of mostly methane and carbon dioxide, with 3% to 6% carbon monoxide.

- First practical use of town gas in modern times was for street lighting
- The first public street lighting with gas took place in Pall Mall, London on January 28, 1807
- Baltimore, Maryland began the first commercial gas lighting project in 1816



## History of Gasification cont'd:

- Used during World War II to convert coal into transportation fuels (Fischer – Tropsch)
- Used extensively in the last 50+ years to convert coal and heavy oil into hydrogen – for the production of fertilizer's for the agriculture and farming industries
- Chemical industry (1960's)
- Refinery industry (1980's)
- Global power industries (Today)

# Summary of Plasma Gasification Benefits

- Not burning or incineration
- Clean “Green Power” from renewable resources
- Environmentally responsible way to generate power and provide ultra pure diesel
- Economically beneficial for City and area residents
- Help reduce dependence on foreign oil for energy
- Keeps hard earned US dollars in the US